FIELD DEVICES - TEMPERATURE
Product Specifications

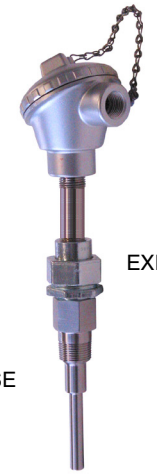
INVENSYS PROCESS SYSTEMS

PSS 1-1B1 A

PR Series RTDs
Platinum Resistance Temperature Detectors



WEATHERPROOF/GENERAL PURPOSE
CONNECTION HEAD
WITH BARE SENSOR



WEATHERPROOF/GENERAL PURPOSE
CONNECTION HEAD
WITH COUPLER AND
THERMOWELL



EXPLOSIONPROOF/FLAMEPROOF
CONNECTION HEAD
WITH BARE SENSOR



EXPLOSIONPROOF/FLAMEPROOF
CONNECTION HEAD
WITH COUPLER AND
THERMOWELL

The Foxboro® brand PR Series RTDs are available from Invensys Process Systems (IPS). These RTDs are sensors whose electrical resistance changes with a change in temperature. They measure temperatures from -200 to +650°C (-320 to +1200°F) and are calibrated to either ASTM (IEC, DIN) or SAMA standard curves. The resistance output from the element may be directly connected to a variety of resistance temperature measurement instruments.

WIDE TEMPERATURE RANGE

Platinum RTDs are an ideal selection in applications having a wide temperature range. These PR Series sensors have a wider temperature rangeability than any other conventional resistance temperature measuring device.

USABLE WITH MANY TYPES OF FIELD DEVICES

RTDs may be directly connected to a variety of Foxboro instruments such as transmitters, controllers, compensated totalizers, converters, or system input modules.

FOXBORO

A VARIETY OF CONFIGURATIONS

The PR Series can accommodate either a single or dual RTD element. They are available as either bare sheath or well type assemblies. In either configuration, the sensor is protected with a full length moisture resistant sheath of either AISI Type 316 stainless steel (316 ss) or Inconel 600, depending upon the temperature or process material being measured. An excellent selection of specially engineered wells is available to further protect the RTD from physical damage or from corrosive or damaging process media. RTD insertion lengths are available in lengths from 51 to 914 mm (2 to 36 in) in 12.7 mm (1/2 in) increments. Custom lengths are also available from 37 through 300 inches in whole inch increments. Weatherproof (IEC IP65, NEMA Type 4) terminal connection heads are offered for general purpose applications, and explosionproof/flameproof (IEC IP65, NEMA Type 4X) terminal connection heads are offered for corrosive or hazardous area installations.

SPRING LOADED CONSTRUCTION WITH WELLS

When wells are used, a spring loading device is used to provide positive tip contact between the element and thermowell bottom. This ensures a reliable temperature measurement.

LONG LIFE, LOW MAINTENANCE

The use of protective sheathing and wells increases the life of the sensor while ensuring low heat loss and suitable thermal response. When wells are used, the spring-loaded RTD can be easily removed without process shutdown. Longer sensor life results in lower maintenance costs and reduced spare parts inventory.

MANY AGENCY APPROVALS/CERTIFICATIONS

Approved/Certified by FM, FMc, and CSA for Explosionproof locations; and certified for Flameproof locations by ATEX and IECEx.

PERFORMANCE SPECIFICATIONS

Accuracy

ASTM-A CALIBRATION SENSORS

±0.13 + 0.0017(T)°C, where T = °C temperature, absolute value. (Better than IEC-A calibration accuracy.)

ASTM-B CALIBRATION SENSORS

±0.25 + 0.0042(T)°C, where T = °C temperature, absolute value. (Better than DIN and IEC-B calibration accuracy.)

SAMA CALIBRATION SENSORS

±0.26°C (±0.5°F) or ±0.25% of temperature reading, whichever is larger, for 480°C (900°F) and below; ±0.5% of temperature reading between 480 and 650°C (900 and 1200°F).

Reproducibility

±0.125°C (±0.25°F) for 480°C (900°F) and below; ±0.25°C (±0.5°F) for above 480°C (900°F).

Operational Stability

Less than ±0.06°C (±0.1°F) shift from initial calibration in one year.

Response Time

5 seconds maximum for a 63% recovery; based on a step change in temperature of the bare sensor starting at an ambient room temperature of 25°C (77°F) to being immersed in 100°F) (212°F) water stirred at 1 m/s (3 ft/s).

FUNCTIONAL SPECIFICATIONS

Temperature Limits

The maximum temperature limit is determined by the lowest upper range limit (URL) of the element, connection head, or sheath.

ELEMENT

-200 and +650°C (-330 and +1200°F)

CONNECTION HEAD

-40 and +105°C (-40 and +220°F)

316 ss SHEATH

-200 and +480°C (-320 and +900°F)

INCONEL SHEATH

-200 and +650°C (-320 and +1200°F)

Vibration

A detector, with 76 mm (3 in) of its sheathed length unsupported or overhanging, will withstand 250 m/s^2 (25 “g”) vibration from 20 to 2000 Hz in any axis for 25 minutes without damage.

External Pressure

The detector sheath can be exposed to an external pressure of 21 MPa (3000 psi) without a change in resistance of more than the amount equivalent to 0.05°C (0.1°F). There will be no permanent change in the resistance at the ice point after this exposure.

ASTM Calibration

Per ASTM E1137-87. Resistance at 0°C (32°F) is as follows (also conform to DIN and IEC calibrations):

- for ASTM-B, 100.00 ± 0.10 Ω
- for ASTM-A, 100.00 ± 0.05 Ω

Refer to TI 005-028. Alpha is 0.00385 Ω/Ω/°C.

SAMA Calibration

SAMA Standard RC 21-4-1966. Curves PR 279 (°C) and PR 278 (°F). Alpha is 0.003923 Ω/Ω/°C. Resistance of 98.129 ±0.1 Ω at 0°C (32°F). Refer to TI 5-27a.

PHYSICAL SPECIFICATIONS

RTD Configurations

See Figure 1. Three configurations are offered. A well-type assembly with a nipple coupler; a well-type assembly with a nipple and union coupler; and a bare element-type assembly. The bare element-type assembly has a hex-head nipple with 1/2 NPT external thread welded on sensor for process mounting and mounting to connection head.

Sensor Type

Single or dual platinum resistance temperature sensor, strain free, fully annealed, with three-lead configuration. Four-wire RTDs are available on request.

Sensor Wires

Three leads are color coded white, and two red. White for the one leg of the detector, and the two reds for the two legs to the other side of the detector. Stranded 0.50 mm^2 or 22 AWG wire with ptfe insulation.

Sensitive Length

40 mm (1.6 in) minimum, measured from closed end.

Internal Insulation

Glass fiber over sensitive length, high-purity aluminum oxide powder packed over remaining length.

Sheath Sealant

Epoxy compound applied at open end of sheath to prevent entry of moisture.

Sheath Outside Diameter (O.D.)

6.35 mm (0.250 in). Note that a well inside diameter (I.D.) of 6.60 mm (0.260 in) is required.

Insertion Length

Refer to Model Code.

Construction

All welded and moisture sealed. 316 ss for temperature up to 480°C (900°F), Inconel 600 for temperatures up to 650°C (1200°F).

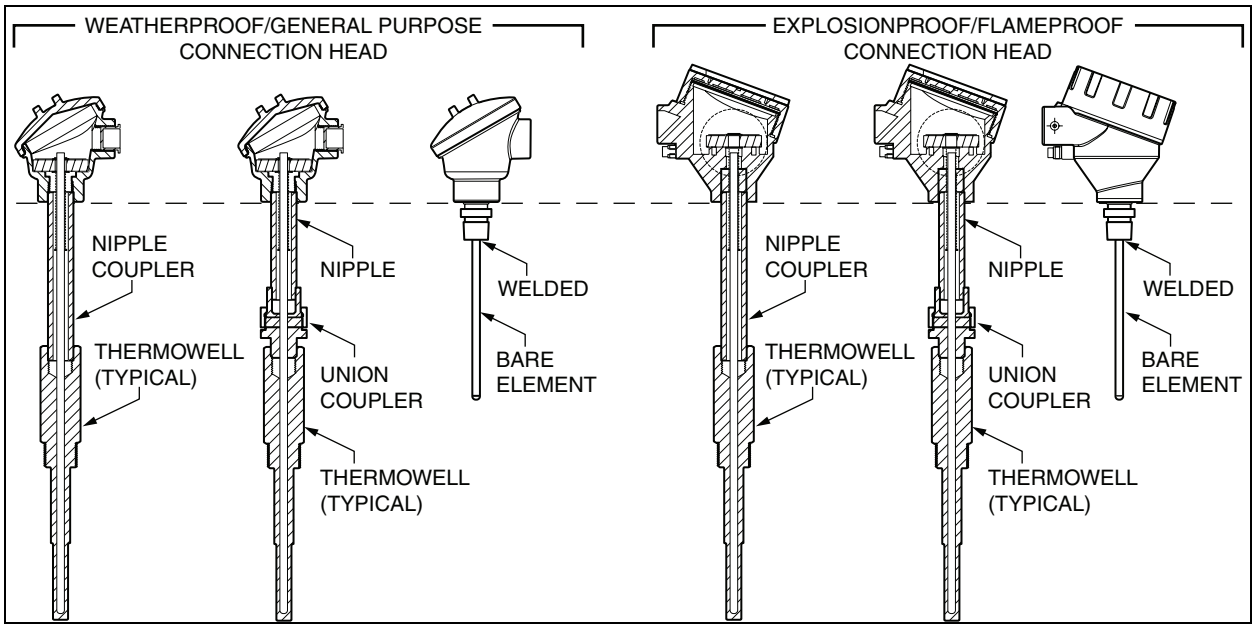


Figure 1. PR Series RTD Configurations

PHYSICAL SPECIFICATIONS (CONT.)

Weatherproof/General Purpose Connection Head

This connection head when used with a well, contains a compression spring to maintain RTD tip contact. Diecast aluminum alloy with O-ring gasketed cover. A 1/2 NPT conduit connection (or optionally an M20 conduit thread adapter) is provided for field wiring to a ceramic terminal block within the connection head. The assembly meets IEC IP65, provides the environmental protection of NEMA Type 4. See Figure 1.

Explosionproof/Flameproof Connection Head

This connection head is used to protect conductors in conduit systems within hazardous areas. The head contains a compression spring to maintain RTD tip contact. Diecast low copper aluminum alloy, painted, with an O-ring gasketed cover. A 1/2 NPT conduit connection is provided for field wiring to a ceramic terminal block within the connection head. The assembly meets IP65 and provides the environmental and corrosion resistance protection of NEMA Type 4X. See Figure 1.

Thermowells

Foxboro wells isolate the process and separate the temperature-measuring sensitive portion of the thermocouple from potentially corrosive or damaging process media. These wells permit ready removal of the sensor without process shutdown. A selection of plain or lagged, threaded or flanged, solid, welded or tapered wells is available in a variety of sizes and materials. The wells are machined from industry standard 316 ss, and a polished finish assures maximum corrosion resistance. They are manufactured in accordance with applicable ASME, ASTM, and ANSI standards. Refer to PSS 3-3D1 A for T Series Wells, and to PSS 3-3C1 A for W Series Wells. Also see Figure 2.

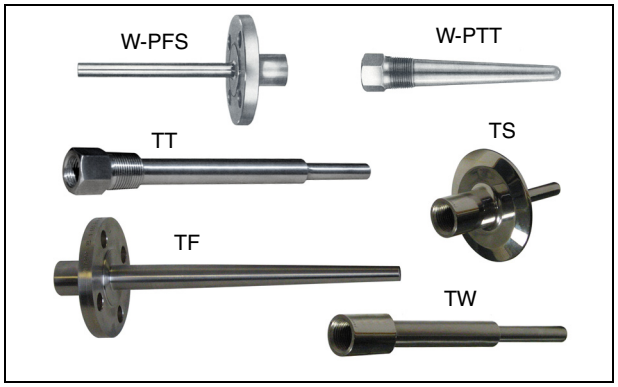


Figure 2. Typical W-Series and T-Series Wells

Terminal Block

As mentioned previously, a terminal block is located within the connection head. Field wires enter through the 1/2 NPT conduit connection (or optional M20 conduit thread adapter) in the head and terminate under screw terminals on the block. The terminal block accommodates either a single or dual element sensor. Refer to Figure 3.

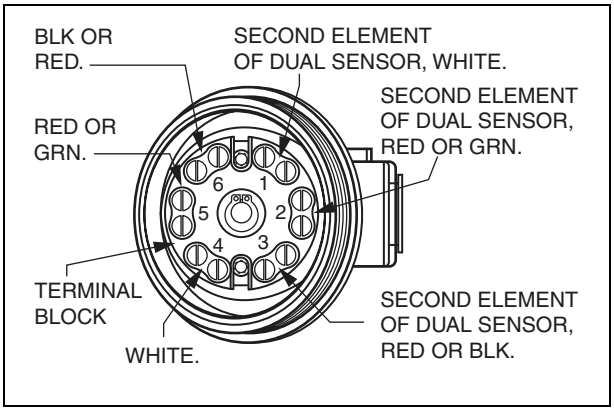


Figure 3. Terminal Block Configuration

Dimensions

See Dimensions-Nominal section.

PRODUCT SAFETY SPECIFICATIONS

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions (a)	Connection Head Code (a)
FM and **FMc** explosionproof for Class I, Division 1, Groups B, C, and D; Dust-ignitionproof for Class II, Division 1, Groups E, F, and G; and Class III, Division 1.	Temperature Class T5; Ta = -50 to +85°C	4
CSA explosionproof for Class I, Division 1, Groups B, C, and D; Dust-ignitionproof for Class II, Division 1, Groups E, F, and G; and Class III, Division 1.	Temperature Class T5; Ta = -40 to +85°C	5
ATEX flameproof; II 1/2 G, Ex d IIC; or II 2 G, Ex d IIC; or II 2 D.	Construction Types N, P, W, and B only. Temperature Class: ▸ T5 (100°C), Ta = -40 to +85°C ▸ T6 (85°C), Ta = -40 to +75°C	6
IECEx flameproof; Ex d IIC	Construction Types N, P, W, and B only. Temperature Class: ▸ T5, Ta = -40 to +85°C ▸ T6, Ta = -40 to +75°C	7

(a) Refer to Model Code for descriptions of Construction Codes and Certifications Codes.

NOTE

These RTDs have been designed to meet the product safety descriptions listed above. For detailed information, or status of testing laboratory approvals/certifications, contact IPS.

OPTIONAL SELECTIONS AND ACCESSORIES

Accessory: Platinum Replacement Element Assemblies

Specify part number if known, calibration standard, sheath material, and single or dual sensor. Also for well type construction, additionally specify the “S” length (length of sensor sheath). And for bare element assemblies, also specify the “A” length (see Dimensions - Nominal section).

Accessory: RTD to Instrument Cable

Three wires, stranded copper, 1.0 mm^2 or 18 AWG. Polyethylene insulation is 8.4 mm (0.33 in). Temperature limit is 90°C (195°F). Specify Part Number R0101LY and desired length.

Option -A3: Metric Conduit Thread Adapter

An 1/2 NPT to M20 X 1.5 metric conduit thread adapter is provided for Connection Head Codes 6 and 7. Select Option -A3.

Option -C1: Calibration Certificate

3-point RTD calibration. For standard or special calibration curves. Select Option -C1.

Options -C2, -C3, and -C4: Cryogenic Calibrations

Option	Cryogenic Calibration
-C2	-40 to -75°C (-40 to -100°F)
-C3	-75 to -130°C (-100 to -200°F)
-C4	-130 to -200°C (-200 to -320°F)

Option -C5: Oxygen Service

The RTD is cleaned and prepared for Oxygen Service. Select Option -C5.

OPTIONAL SELECTIONS AND ACCESSORIES (CONT.)

Options -T1, -T2, and -T3: Packing Type Couplers (With Bare Element Code B only)

With user-supplied wells only. Available in 1/2, 3/4, or 1 NPT sizes, and an "E" length of 100 mm (4 in). See table below and Figure 4.

Packing Type Couplers

Option	NPT	"E" Length	Part Number
-T1	1/2	100 mm (4 in)	B0184HX
-T2	3/4	100 mm (4 in)	B0184HY
-T3	1	100 mm (4 in)	B0184HZ

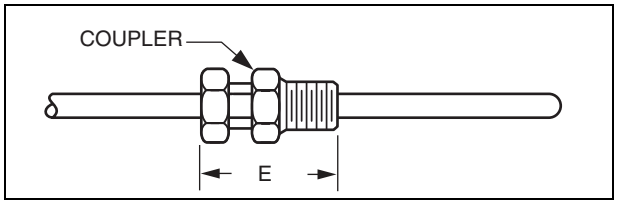


Figure 4. Packing Type Coupler

Options -T4 and -T5: Bare Sheath Type Couplers (With Bare Element Code B only)

Used for spring loading with user-supplied wells only. Available in 1/2 and 3/4 NPT sizes, and an "E" length of 38 mm (1.50 in). See table below and Figure 5.

Bare Sheath Type Couplers

Option	NPT	"E" Length	Part Number
-T4	1/2	38 mm (1.50 in)	E0127CX
-T5	3/4	38 mm (1.50 in)	Z0000361

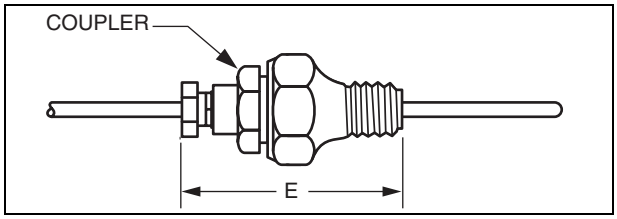


Figure 5. Bare Sheath Type Coupler

Options -T6 and -T7: Compression Type Couplers (With Bare Element Code B only)

With user-supplied wells only. Available in 1/4 and 1/2 NPT sizes, and an "E" length of 32 mm (1.25 in). See table below and Figure 6.

Compression Type Couplers

Option	NPT	"E" Length	Mat'l	Part No.
-T6	1/4	32 mm (1.25 in)	Brass	K0106NE
		32 mm (1.25 in)	316 ss	X0171SY
-T7	1/2	32 mm (1.25 in)	Brass	X0172ZB
		32 mm (1.25 in)	316 ss	X0172ZC

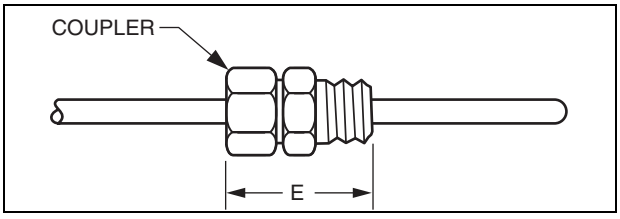


Figure 6. Compression Type Coupler

MODEL CODE

Description	Model
Platinum RTD	PR
Sensor Type (a)	
Single Element	-1
Dual Element	-2
Connection Head (a)	
Weatherproof/General Purpose	3
Explosionproof and Weatherproof, FM and FMc Approvals (f)	4
Explosionproof and Weatherproof, CSA Certification (f)	5
Flameproof and Weatherproof, ATEX Certification (f)(g)	6
Flameproof and Weatherproof, IECEx Certification (f)(g)	7
Construction (a)	
Well Type, Nipple Coupler, steel (for connection to Well) (d)	N
Well Type, Nipple Coupler, 316 ss (for connection to Well) (d)	P
Well Type, Union Coupler, steel (for connection to Well) (d)(g)	U
Well Type, Union Coupler, 316 ss (for connection to Well) (d)	W
Bare Element with 316Lss threaded hex fitting (1/2 NPT external thread) welded on to sensor	B
Calibration Curve (b)	
ASTM-B (Standard - same as DIN and IEC-B calibration curves)	B
ASTM-A (High Accuracy selection; same as IEC-A calibration curve)	A
SAMA - 3-Wire	S
Sheath - 6.35 mm (0.25 in) O.D.	
316 ss	S
Inconel	I
Length "U" or "U + T" Dimension (c)	
51 mm (2.0 in)	-002
76 mm (3.0 in)	-00A
90 mm (3.5 in)	-003
102 mm (4 in)	-004
127 mm (5 in)	-005
152 mm (6 in)	-006
178 mm (7 in)	-007
203 mm (8 in)	-008
229 mm (9 in)	-009
254 mm (10 in)	-010
279 mm (11 in)	-011
305 mm (12 in)	-012
330 mm (13 in)	-013
356 mm (14 in)	-014
381 mm (15 in)	-015
406 mm (16 in)	-016
432 mm (17 in)	-017
457 mm (18 in)	-018
483 mm (19 in)	-019
508 mm (20 in)	-020

Model Code continued on next page

MODEL CODE (CONT.)

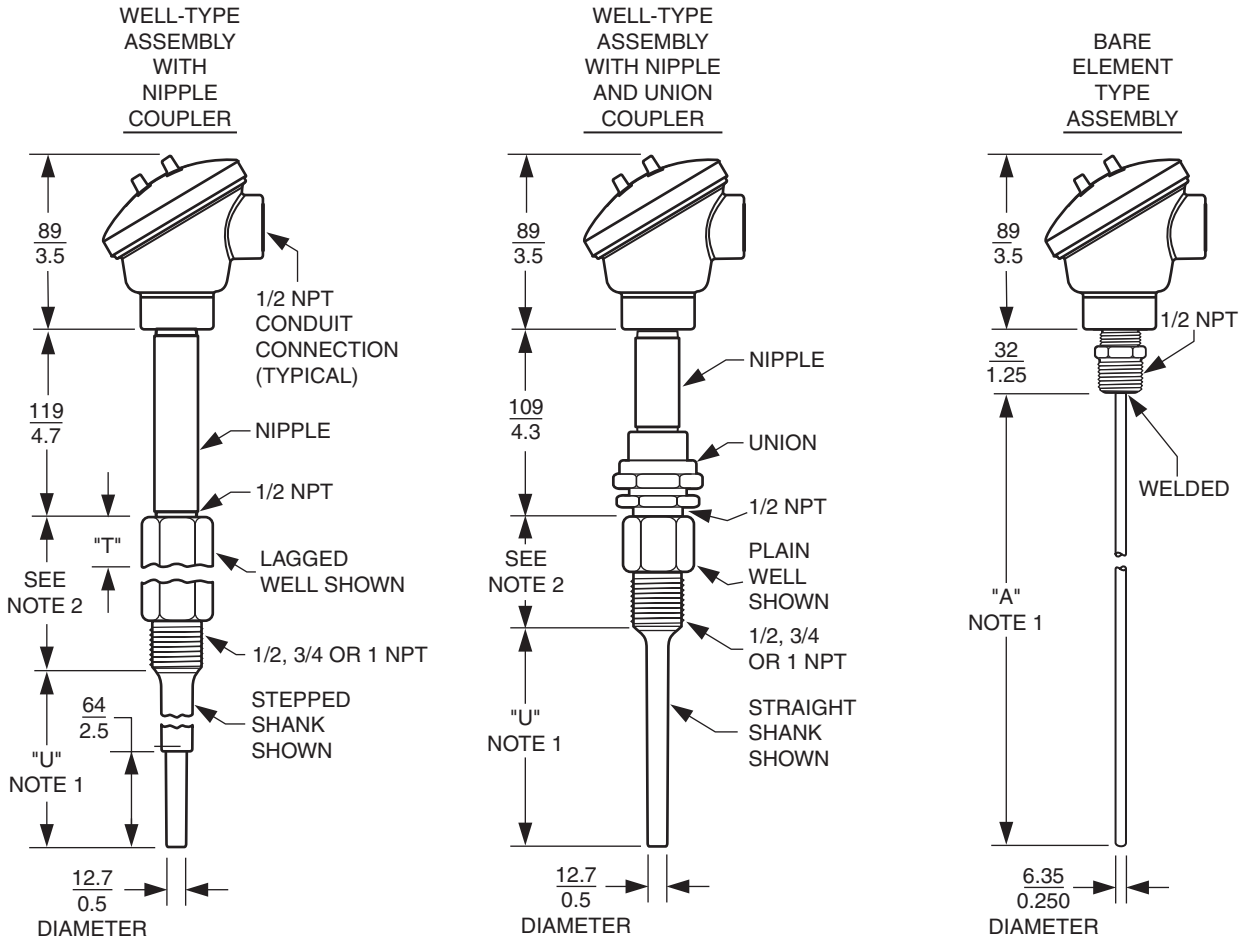
Length "U" or "U & T" Dimension (Cont.) (c)	Model
533 mm (21 in)	-021
559 mm (22 in)	-022
584 mm (23 in)	-023
610 mm (24 in)	-024
635 mm (25 in)	-025
660 mm (26 in)	-026
686 mm (27 in)	-027
711 mm (28 in)	-028
737 mm (29 in)	-029
762 mm (30 in)	-030
787 mm (31 in)	-031
813 mm (32 in)	-032
838 mm (33 in)	-033
864 mm (34 in)	-034
889 mm (35 in)	-035
914 mm (36 in)	-036
Nonstandard length are whole inches from 37 through 300 inches; specify desired length by substituting numerical values for Xs; e.g., -048 = 48 inches	-XXX
Optional Selections	
Sensor Length 0.5 in longer than the specified length; (not available with Length Codes 00A or 003)	-H
Shipped without Thermowell; for customer to install thermowell (e)	-W
Thermowell other than the Standard -T Series Wells	-X
Threaded Coupler Options for Bare Elements - Code B	
Packing Type, 1/2 NPT	-T1
Packing Type, 3/4 NPT	-T2
Packing Type, 1 NPT	-T3
Spring Loading Type, 1/2 NPT	-T4
Spring Loading Type, 3/4 NPT	-T5
Compression Type, 1/4 NPT	-T6
Compression Type, 1/2 NPT	-T7
Other Options	
Metric Conduit Thread Adapter (1/2 NPT by M20 X 1.5) (h)	-A3
Three Point Calibration with Certificate	-C1
Cryogenic Calibration; -40 to -75°C (-40 to -100°F)	-C2
Cryogenic Calibration; -75 to -130°C (-100 to -200°F)	-C3
Cryogenic Calibration; -130 to -200°C (-200 to -320°F)	-C4
Cleaned and Prepared for Oxygen Service	-C5
Examples: PR-13NBS-012-C1; PR-14BSS-024-T1C1	

(a) See Figure 1 and DIMENSIONS-NOMINAL section for RTD assembly configurations.
(b) See Performance Specifications section for Calibration Curve Accuracy.
(c) With a bare sheath assembly, the "U" or "U + T" dimension is identified as the "A" dimension. See DIMENSIONS-NOMINAL section.
(d) For Well Type construction, the well must be specified separately. Refer to PHYSICAL SPECIFICATIONS section.
(e) No Agency electrical safety certifications apply.
(f) Thermowells for Explosionproof/Flameproof atmospheres are only available in the following materials: carbon steel C-1018, 316 ss, 316L ss, 304 ss, 304L ss, Alloy 20 Cb-3, Hastelloy B, Hastelloy C-276, Inconel 600, R-Monel 405, K-Monel 500, Nickel 200, Titanium, and Cr/Moly steels.
(g) ATEX and IECEx, d, not available with Construction Code U, carbon steel union coupler.
(h) Option -A3 is only available with Connection Head Codes 6 and 7.

DIMENSIONS - NOMINAL

mm
in

WEATHERPROOF/GENERAL PURPOSE CONNECTION HEAD



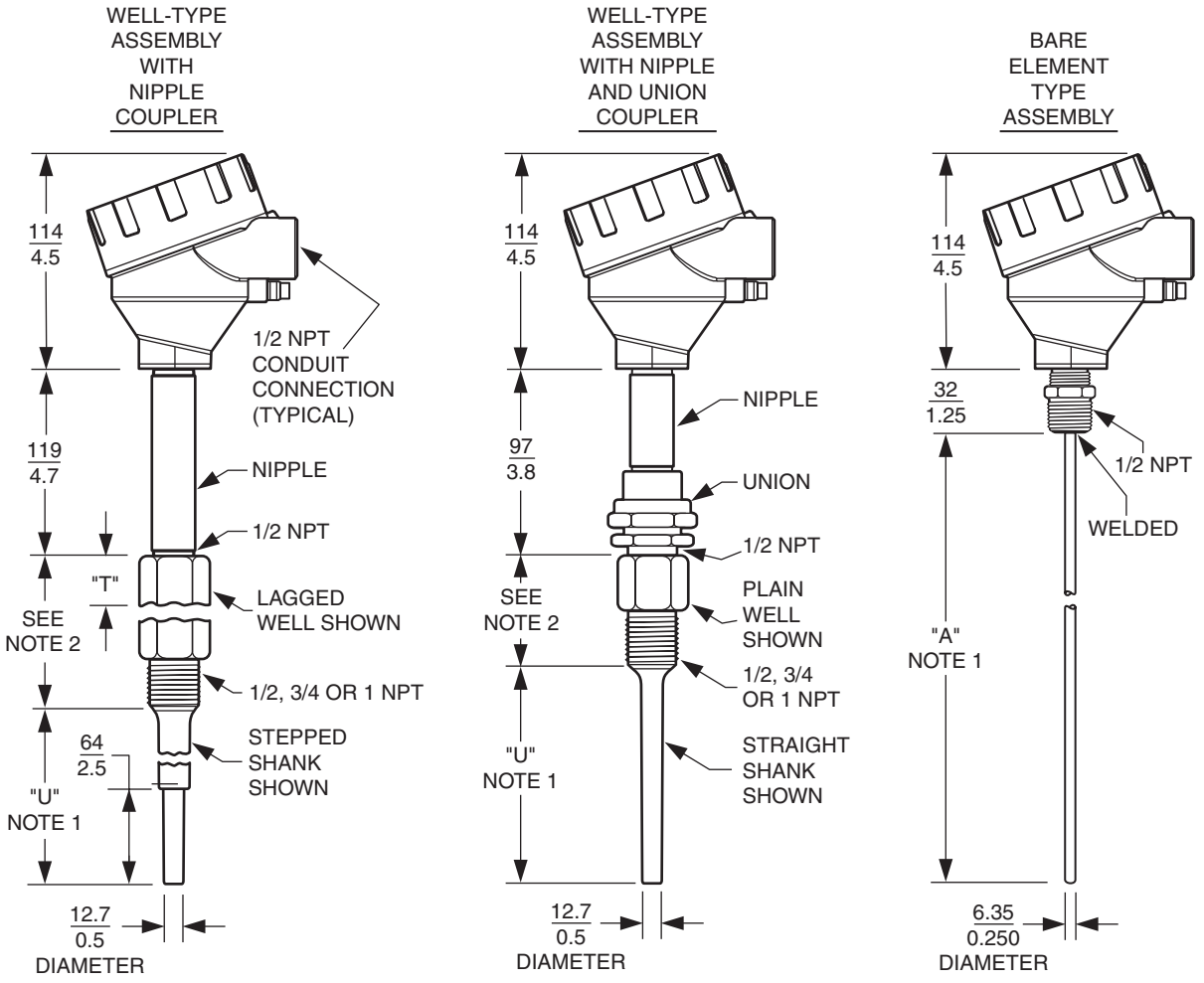
NOTES

1. U = Insertion Length (with well); and A = Bare Sensor Length (without well).
2. A lagged well has a lagging length, T, that is in addition to the length of a plain well, as shown in the two well-type assembly illustrations. The dimension indicated varies depending on the lagging length. This dimension without lagging is nominally 51 mm (2.0 in). For a lagged well, the nominal dimension is 51 mm (2.0 in) plus lagging length T.

DIMENSIONS - NOMINAL

mm
in

EXPLOSIONPROOF/FLAMEPROOF CONNECTION HEAD



NOTES

1. U = Insertion Length (with well); and A = Bare Sensor Length (without well).
2. A lagged well has a lagging length, T, that is in addition to the length of a plain well, as shown in the two well-type assembly illustrations. The dimension indicated varies depending on the lagging length. This dimension without lagging is nominally 51 mm (2.0 in). For a lagged well, the nominal dimension is 51 mm (2.0 in) plus lagging length T.

ORDERING INSTRUCTIONS

1. Model Number
2. Thermowell, if required:
   For “T” Series Wells, see PSS 3-3D1 A
   For “W” Series Wells, see PSS 3-3C1 A
3. Accessories
4. User Tag Data

OTHER FOXBORO TEMPERATURE MEASUREMENT SENSORS

PSS 1-1B3 A	DB Series Nickel RTDs
PSS 1-1B6 A	MT Series MINOX™ Thermocouples
PSS 1-1B7 A	WT Series Wire-Type Thermocouples
PSS 3-3A1 A	Filled Thermal Systems

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